Community Exposure to Perfluorooctanoate: Sources of Exposure and Health Effects

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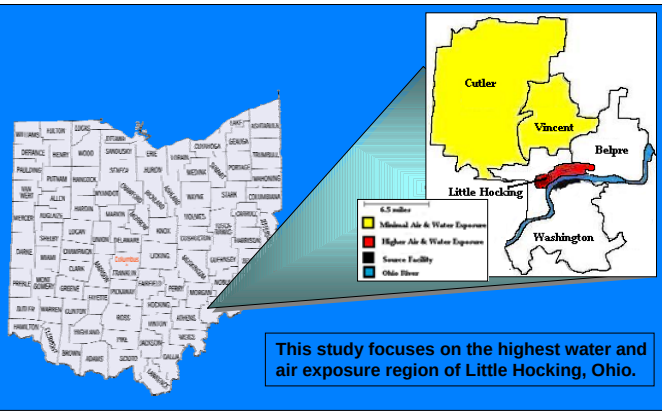
Background

Perfluorooctanoate (PFOA) is used in the production of many common fluoropolymers, including non-stick cookware and all-weather clothing. PFOA is persistent in the environment and the human body, and not biodegradable. PFOA is a known animal carcinogen, causing liver toxicity and developmental delays in animals. PFOA toxicity to humans remains unclear. Low levels of PFOA are now ubiquitous in human serum and biota, worldwide.

"At present, there are no steps EPA recommends ... to reduce exposure... because the sources of PFOA in the environment and the pathways by which people are exposed are unknown. Whether human exposures are due to… air, the water, dusts, sediments, dietary sources or… some combination is unknown" ~ EPA 2005



This study focuses on the highest water and air exposure region of Little Hocking, Ohio.

Objectives

→To determine the levels of C8 in the blood of residents in the Little Hocking water service area and to compare these with levels in other populations.

→To determine the major sources of exposure (water, air, other) influencing the blood C8 levels.

→To determine whether there is an association between blood C8 levels and markers of health effects.

→ To address intense community concerns through an independent community based study

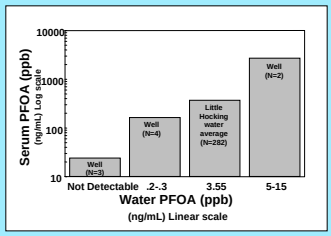
Methods

Questionnaires were administered and blood samples were taken from a stratified random sample of residents & additional volunteers from the Little Hocking water service district. Blood serum [PFOA] was measured by HPLC/tandem MS and we measured various blood biomarkers of possible toxic effects.

Results

1. ***The PFOA levels in the blood serum of the residents of Little Hocking, Ohio are comparatively very high:***

Exposure	PFOA in serum (ppb)
Median PFOA in general US population	5
Median PFOA in Little Hocking water users	374
Median PFOA in Little Hocking water users who worked in production using PFOA	775

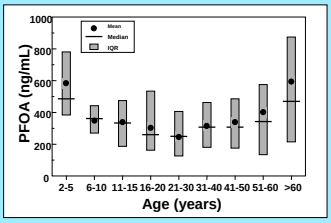


2. ***The primary source for serum PFOA is the Little Hocking water supply. Air exposure had no noticeable effect.***

The highest PFOA serum levels were found in those residents who used Little Hocking water exclusively.

Drinking Water Source	N	PFOA serum (ppb)
Little Hocking water system water only	291	374
Little Hocking plus bottled or spring	26	320
Bottled and/or cistern and/or spring water only	10	71
Residential well water & well & other (* very variable)	26	79*

3. ***For those residents whose primary water source is the Little Hocking water supply, levels of serum PFOA are significantly influenced by the following variables:***



→ *Age:*
Higher serum PFOA in vulnerable age groups: under 5 years and over 60 years

→ *Intake of homegrown fruits and vegetables:*
Higher PFOA serum content in frequent homegrown consumption; may be due to cleaning, cooking, canning processes

→ *Number of tap water drinks per day:*
Higher PFOA serum content with more frequent tap water consumption

→ *Use of carbon filter for tap water*
Modest lowering of PFOA serum content with use of carbon filter; not as effective as bottled water substitution

4. ***No relationship was observed between PFOA levels and the health indicators considered-***

History of liver & thyroid disease

Biomarkers of liver, kidney, thyroid, function

NOW THAT PATHWAYS ARE IDENTIFIED, STEPS CAN BE TAKEN TO REDUCE EXPOSURE.

Recommendations

→Expeditiously institute treatment to remove PFOA from Little Hocking system water, monitor continuing efficacy of treatment
→Ensure reduced PFOA emissions
→If you desire to reduce your PFOA exposure, consider an alternate water source whenever water may be ingested
→Revisit the West Virginia so-called "safe level" of PFOA in water in light of new information

Community Impacts

→Almost immediately following the release of our findings, residents in the Little Hocking water district were provided with the option of up to three liters of bottled water daily, courtesy of the fluoropolymer production company
-- As of January 2006, ~ 70% of Little Hocking residents took advantage of this offer
→A new water treatment facility is being built
→ An improvement in community trust; some community members say "the edge has now been taken off the issue"

Looking to the Future

We are undertaking:
→ A follow-up study to test changes in PFOA levels with treated water sources; & explore PFOA half-life in the human body
→Studies to address the role of fruits and vegetables in PFOA exposure
→Studies addressing cancer risk and childhood development
→ Continuing to answer the public's questions about PFOA

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NIEHS National Institute of Environmental Health Sciences

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